CLAIMS

1. A packet transfer method in a network apparatus that transfers packets, wherein:

a sending side apparatus generates two copies of a send packet, provides a sequence number identifying the same sending sequence to each of the copied packets, provides an identifier corresponding to a send/receive pair to each of the copied packets to send the packets, and

a receiving side apparatus receives each of the packets with two receiving units;

recognizes the identifiers each corresponding to a send/receive pair;

identifies packets having the same information and the sequence based on the sequence number when the identifiers are the same;

selects one of the packets of the same sequence so as to send the packet downstream, and discards another packet, wherein, when only one of the packets of the same sequence arrives, the arriving packet is sent downstream.

2. A packet transfer method in a network apparatus that transfers packets, wherein:

a sending side apparatus generates two copies of a send packet, provides a sequence number identifying the same sending sequence to each of the copied packets, and provides an identifier corresponding to a send/receive pair and an identifier corresponding to a route to each of the copied packets to send the packets, and

a receiving side apparatus receives each of the packets with two receiving units;

recognizes the identifiers each corresponding to a send/receive pair and the identifiers each corresponding to a route;

identifies packets having the same information and the sequence based on the sequence number when the identifiers are the same;

selects one of the packets of the same sequence so as to send the packet downstream, and discards another packet, wherein, when only one of the packets of the same sequence arrives, the arriving packet is sent downstream.

3. The packet transfer method as claimed in claim 1 or 2, wherein the receiving side apparatus temporarily stores the two packets transferred from two routes into two FIFO memories respectively, and selects a packet transferred normally to transfer it downstream.

4. The packet transfer method as claimed in claim 1 or 2, wherein the receiving side apparatus temporarily stores the two packets transferred from two routes into two circulating hash memories respectively, and selects a packet that is transferred normally so as to transfer it downstream.

5. The packet transfer method as claimed

in claim 1 or 2, wherein the receiving side apparatus temporarily stores the two packets transferred from two routes into two FIFO memories respectively, and selects a packet that is transferred normally using a third memory shared by the two receiving units so as to transfer the selected packet downstream.

6. The packet transfer method as claimed in claim 1 or 2, wherein the Ethernet is used as a packet transfer technology.

7. The packet transfer method as claimed in claim 6, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a route and a sequence number.

8. The packet transfer method as claimed in claim 6, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a send/receive pair and a sequence number.

9. The packet transfer method as claimed in claim 6, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a send/receive pair and a sending route and write a sequence number.

10. The packet transfer method as claimed in claim 6, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a sending route, an identifying ID corresponding to a send/receive pair, and a sequence number.

11. The packet transfer method as claimed in claim 1 or 2, wherein MPLS is used as a packet transfer technology.

12. The packet transfer method as claimed in claim 11, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a sending route, and a sequence number.

13. The packet transfer method as claimed in claim 11, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a send/receive pair, and a sequence number.

14. The packet transfer method as claimed in claim 11, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a sending route, an identifying ID corresponding to a send/receive pair, and a sequence number.

15. The packet transfer method as claimed in claim 11, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a sending route and a send/receive pair, and a sequence number.

16. The packet transfer method as claimed in claim 4 or 5, wherein a region of the memory using the circulating hash is divided into n (n is an integer no less than 2) to which addresses 1-n are assigned,

when the receiving side apparatus receives a packet, the receiving side apparatus stores the packet in a memory region of an address that is a reminder of the counter value when divided by n,

even when a packet having a counter value of N arrives prior to a packet having a counter value of N-n, the packet is once stored in the memory region of an address that is a reminder of the counter value N when divided by n, and when reading out the packet, the packet is read out in the order of the counter value, so that reversal of arriving sequence within n is corrected to a correct sequence when reading out the packet.

17. The packet transfer method as claimed in claim 1 or 2, wherein a packet transfer technology utilizing encapsulation of a variable-length packet is used.

18. The packet transfer method as claimed in claim 17, wherein, when providing a header to the variable-length packet for encapsulation, the counter field is inserted after the header for encapsulation so as to write the sequence number.

19. The packet transfer method as claimed in claim 18, wherein the receiving side apparatus extracts an identifier corresponding to a send/receive pair or an identifier corresponding to a route from the header for encapsulation.

20. A packet transfer apparatus for transferring packets, comprising:

sending function means comprising:

copy means for generating two copies from a send packet;

number/identifier providing means for providing a sequence number identifying the same sending sequence to each of the packets copied by the copy means, and providing an identifier corresponding to a send/receive pair to each of the copied packets;

packet sending means for sending the two packets to which the sequence number and the identifier are provided; and

receiving function means comprising:

packet receiving means for receiving each of the two packets sent from the sending function means;

memories each for storing one of the two received packets;

selection means for reading out the two packets stored in the memories, recognizing the identifiers each corresponding to a send/receive pair, identifying packets having the same information and the sequence based on the sequence number when the identifiers are the same, and selecting one of the packets of the same sequence; and

sending means for sending the packet selected in the selection means downstream, and discarding another packet, wherein, when only one of the packets of the same sequence arrives, the arriving packet is sent downstream.

21. A packet transfer apparatus for transferring packets, comprising:

sending function means comprising:

copy means for generating two copies from a send packet;

number/identifier providing means for providing a sequence number identifying the same sending sequence to each of the packets copied by the copy means, and providing an identifier corresponding to a send/receive pair and an identifier corresponding to a route to each of the copied packets;

packet sending means for sending the two packets to which the sequence number and the identifier are provided; and

receiving function means comprising:

packet receiving means for receiving each of the packets sent from the sending function means;

memories each for storing one of the two received packets;

selection means for reading out the two packets stored in the memories, recognizing the identifiers each corresponding to a send/receive pair and identifiers each corresponding to a route, identifying packets having the same information and the sequence based on the sequence number when the identifiers are the same, and selecting one of the packets of the same sequence; and

sending means for sending the packet selected in the selection means downstream, and discarding another packet, wherein, when only one of the packets of the same sequence arrives, the arriving packet is sent downstream.

22. The packet transfer apparatus as claimed in claim 20 or 21, wherein the memories are FIFO memories, and the selection means of the receiving function means includes means for selecting a packet transferred normally from the packets temporarily stored in two FIFO memories.

23. The packet transfer apparatus as claimed in claim 20 or 21, wherein the memories are circulating hash memories, and the selection means of the receiving function means includes means for selecting a packet that is transferred normally from among packets temporarily stored in the two circulating hash memories.

24. The packet transfer apparatus as claimed in claim 20 or 21, wherein the memories are FIFO memories, and the receiving function means includes a third memory shared by the two packet receiving means, and includes means for selecting a packet that is transferred normally using the third memory as a circulating hash.

25. The packet transfer apparatus as claimed in claim 20 or 21, wherein the Ethernet is used as a packet transfer technology in the sending

function means and the receiving function means.

26. The packet transfer apparatus as claimed in claim 25, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a route and a sequence number.

27. The packet transfer apparatus as claimed in claim 25, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a send/receive pair and a sequence number.

28. The packet transfer apparatus as claimed in claim 25, wherein a tag field and a counter field are inserted following a source MAC address in an Ethernet packet so as to write a VLAN tag corresponding to a send/receive pair and a sending route and write a sequence number.

29. The packet transfer apparatus as claimed in claim 25, wherein a tag field and a counter field are inserted following a source MAC

address in an Ethernet packet so as to write a VLAN tag corresponding to a sending route, an identifying ID corresponding to a send/receive pair, and a sequence number.

30. The packet transfer apparatus as claimed in claim 20 or 21, wherein MPLS is used as a packet transfer technology.

31. The packet transfer apparatus as claimed in claim 30, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a sending route, and a sequence number.

32. The packet transfer apparatus as claimed in claim 30, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a send/receive pair, and a sequence number.

33. The packet transfer apparatus as claimed in claim 30, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a

sending route, an identifying ID corresponding to a send/receive pair, and a sequence number.

34. The packet transfer apparatus as claimed in claim 30, wherein a tag field and a counter field are inserted before a shim header of MPLS so as to write a shim header corresponding to a sending route and a send/receive pair, and a sequence number.

35. The packet transfer apparatus as claimed in claim 25 or 26, wherein a region of the memory using the circulating hash is divided into n (n is an integer no less than 2) to which addresses 1-n are assigned,

when the packet transfer apparatus receives a packet, the packet transfer apparatus stores the packet in a memory region of an address that is a reminder of the counter value when divided by n,

even when a packet having a counter value of N arrives prior to a packet having a counter value of N-n, the packet is once stored in the memory region of an address that is a reminder of the counter value N when divided by n, and when reading out the packet, the packet is read out in the order of the counter value, so that reversal of arriving sequence within n is corrected to a correct sequence when reading out the packet.

36. The packet transfer apparatus as claimed in claim 20 or 21, wherein a packet transfer technology utilizing encapsulation of a variable-length packet is used.

37. The packet transfer apparatus as claimed in claim 36, wherein, when providing a header to the variable-length packet for encapsulation, the counter field is inserted after the header for encapsulation so as to write the sequence number.

38. The packet transfer apparatus as claimed in claim 37, wherein the packet transfer apparatus extracts an identifier corresponding to a send/receive pair or an identifier corresponding to a route from the header for encapsulation.

39. A packet transfer method performed by packet transfer apparatuses provided in a packet sending side and a receiving side in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, wherein :

equal to or more than two independent routes are set between the sending side packet

transfer apparatus and the receiving side packet transfer apparatus;

the sending side packet transfer apparatus inserts information identifying a sequence of a packet into a part of the packet that is not referred to for determining the transfer destination of the packet, copies the packet to generate equal to or more than two packets, and sends the packets over the independent routes respectively; and

the receiving side packet transfer apparatus receives each packet from the independent routes, refers to the information identifying the sequence for each packet to identify packets having the same information and the sequence, and transfer one of the packets having the same information downward in the order of the sequence of the packet.

40. The packet transfer method as claimed claim 39, wherein the sending side packet transfer apparatus inserts route identifying information, for identifying the independent route, as a part of destination information for determining a transfer destination in the communication network, and sends the packet to a route identified by the route identifier.

41. The packet transfer method as claimed claim 39 or 40, wherein the sending side packet transfer apparatus inserts source identifying information, at least for identifying the sending side packet transfer apparatus, into the packet; and

the receiving side packet transfer apparatus refers to the source identifying information so as to identify packets having the same information and the sequence.

42. The packet transfer method as claimed claim 39, wherein the equal to or more than two independent routes are equal to or more than two routes that are physically independent, or equal to or more than two private lines.

43. A packet transfer apparatus used in a packet transfer system including a plurality of packet transfer apparatuses provided in a packet sending side and a receiving side via equal to or more than two independent routes in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, the packet transfer apparatus comprising sending function means and receiving function means, the sending function means comprising:

inserting means for inserting information identifying a sequence of a packet into a part of the packet that is not referred to for determining the transfer destination of the packet;

copying means for copying the packet to generate equal to or more than two packets; and

sending means for sending the packets over the independent routes respectively;

the receiving function means comprising:

receiving means for receiving each packet from the independent routes;

identifying means for referring to the information identifying the sequence for each packet to identify packets having the same information and the sequence; and

selection means for transferring one of the packets having the same information identified by the identifying means downstream in the order of the sequence of the packet.

44. The packet transfer apparatus as claimed claim 43, wherein the inserting means in the sending function means inserts route identifying information, for identifying the independent route, as a part of destination information for determining a transfer destination in the communication network, and the sending means sends the packet to a route identified by the route identifier.

45. The packet transfer apparatus as claimed in claim 43 or 44, wherein the inserting means in the sending function means inserts source identifying information, at least for identifying the sending side packet transfer apparatus, into the packet; and

the identifying means in the receiving function means refers to the source identifying information so as to identify packets having the same information and the sequence.

46. The packet transfer apparatus as claimed claim 43, wherein the equal to or more than two independent routes are equal to or more than two routes that are physically independent, or equal to or more than two private lines.

47. A packet transfer method performed by packet transfer apparatuses provided in a packet sending side and a receiving side in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, wherein:

equal to or more than two independent routes are set between the sending side packet transfer apparatus and the receiving side packet transfer apparatus;

the sending side packet transfer apparatus distinguishes a high reliability packet from non-high reliability packets by referring to a part of a packet header of the packet, and copies the high reliability packet into packets to send them to all of the independent routes respectively;

the receiving side packet transfer apparatus determines whether an arriving packet from the independent routes is the high reliability packet by referring to a part of the packet header, and as to high reliability packets, the receiving side packet transfer apparatus determines sameness of packet data arriving from the plurality of routes,

when the same packets arrives from equal to or more than two routes, the receiving side packet

transfer apparatus transfers only one of the same packets downstream and discards other packets; and

when the same packet arrives from only one route, the receiving side packet transfer apparatus transfers the packet downstream.

48. The packet transfer method as claimed in claim 47, wherein, when a packet to be transferred is an Ethernet packet, the part of the packet header is any one of a port number at which the packet arrives in a previous switch of the packet transfer apparatus, a Type value of layer 3 protocol in a frame header, a destination MAC address in a frame header, a source MAC address, a priority (CoS value) included in 802.1Q VLAN tag, VLAN-ID, a DiffServ code/point value (ToS value) included in an IP header, a destination port number, a source port number of UDP, a destination port number, and a source port number of TCP,

when the packet to be transferred is a packet for MPLS, the part of the packet header is any one of a destination MAC address, a source MAC address, and a CoS value (Exp value) of a shim header, and

when the packet to be transferred includes an IP packet, the part of the packet header is any one of a ToS value of the IP packet, a source IP address, and a destination IP address.

49. The packet transfer method as claimed in claim 47, wherein the receiving side packet

transfer apparatus determines the sameness of packets arriving from the plurality of routes based on a value obtained by applying a predetermined function to each packet arriving from the plurality of routes.

50. The packet transfer method as claimed in claim 47, wherein the sending side packet transfer apparatus inserts a sequence identifier or a timestamp into a send packet, wherein the receiving side packet transfer apparatus determines the sameness of packets arriving from the plurality of routes by referring to the sequence identifier or the timestamp inserted in the sending side.

51. The packet transfer method as claimed in claim 50, wherein, when one or more VLAN tags or shim headers are provided to the packet, the sending side packet transfer apparatus inserts the sequence identifier or the timestamp in the inside of an innermost VLAN tag or header in the VLAN tags or shim headers, and the receiving side packet transfer apparatus determines a position for reading out the sequence identifier or the timestamp inserted in the packet according to the inserted position.

52. The packet transfer method as claimed in claim 50, wherein, a format of the sequence

identifier or the timestamp inserted into the packet by the sending side packet transfer apparatus is the same as a format of a VLAN tag conforming to 802.1Q standard, and the sending side packet transfer apparatus writes sequence information or time information into a VLAN-ID field of the VLAN tag.

53. The packet transfer method as claimed in claim 50, wherein the field in which the sequence information or the time information is written as the sequence identifier or the timestamp inserted into the packet by the sending side packet transfer apparatus has an arbitrary length.

54. The packet transfer method as claimed in claim 50, wherein the sending side packet transfer apparatus provides one or more route identifiers to a send packet, and reflects, to at least one route identifier among the route identifiers, priority that is provided to the packet in a user network.

55. The packet transfer method as claimed in claim 54, wherein the sending side packet transfer apparatus provides the route identifier using a VLAN tag or a shim header, and determines priority by referring to a part of a header of the packet so as to reflect the priority to the route

identifier,

wherein, when a packet to be transferred is an Ethernet packet, the part of the packet header is any one of a port number at which the packet arrives in a previous switch of the packet transfer apparatus, a Type value of layer 3 protocol in the packet header, a destination MAC address in a frame header, a source MAC address, a priority (CoS value) included in 802.1Q VLAN tag, VLAN-ID, a DiffServ code/point value (ToS value) included in an IP header, a destination port number, a source port number of UDP, a destination port number, and a source port number of TCP,

when the packet to be transferred is a packet for MPLS, the part of the packet header is any one of a destination MAC address, a source MAC address, and a CoS value (Exp value) of a shim header, and

when the packet to be transferred includes an IP packet, the part of the packet header is any one of a ToS value of the IP packet, a source IP address, and a destination IP address.

56. A packet transfer method performed by packet transfer apparatuses provided in a packet sending side and a receiving side in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, wherein:

equal to or more than two independent routes are set between the sending side packet transfer apparatus and the receiving side packet transfer apparatus;

the sending side packet transfer apparatus

copies the packet so as to send copied packets to all of the independent routes;

the receiving side packet transfer apparatus receives packets from each of the independent routes and refers to sameness identifying information of each packet so as to identify packets having the same information, and to send downstream a packet, among the packets having the same information, that has not yet be transferred, and

the receiving side packet transfer apparatus stores the sameness identifying information of packets already sent downstream for m (m is an integer equal to or greater than one) preceding packets from the newest packet, and compares the stored sameness identifying information with sameness identifying information of a next arriving packet so as to determine whether the arriving packet is one already sent or not.

57. The packet transfer method as claimed in claim 56, wherein the sameness identifying information is a sequence identifier or a timestamp inserted into the packet, or a value obtained by applying a predetermined function to the packet.

58. The packet transfer method as claimed in claim 56, wherein a CAM (Content Addressable Memory) is used as a memory for storing the sameness identifying information in the receiving side packet transfer apparatus.

59. A packet transfer method performed by packet transfer apparatuses provided in a packet sending side and a receiving side in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, wherein:

equal to or more than two independent routes are set between the sending side packet transfer apparatus and the receiving side packet transfer apparatus;

the sending side packet transfer apparatus inserts a sequence identifier for identifying sequence of packets into a send packet and copies the packet so as to send copied packets to all of the independent routes;

the receiving side packet transfer apparatus compares values of sequence identifiers of plural packets received form the independent routes with a value (CF) of a sequence identifier of an already sent packet so as to send a packet downstream in at least one packet having a value as the sequence identifier that is greater than the value (CF) of the sequence identifier of the already transferred packet and that is the least value among the values of the sequence identifiers of the plural packets received from the independent routes.

60. A packet transfer method performed by packet transfer apparatuses provided in a packet sending side and a receiving side in a communication

network for transferring a packet by determining a transfer destination by referring to destination information of the packet, wherein:

a plurality of independent routes are set between the sending side packet transfer apparatus and the receiving side packet transfer apparatus;

the sending side packet transfer apparatus inserts a sequence identifier identifying a sequence of packets into a send packet, and copies the packet so as to send copied packets to all of the independent routes;

the receiving side packet transfer apparatus receives packets from each of the independent routes and refers to the sequence identifier of each packet so as to identify packets having the same information and the sequence, and to send downstream a packet among the packets having the same information in the order of the sequence of the packet,

wherein, in the receiving side packet transfer apparatus, a route from which a packet arrives first from the start of communication among the independent routes is regarded as an active system, the receiving side packet transfer apparatus compares a value (CF) of the sequence identifier of an already transferred packet with a value of the sequence identifier of a packet received in the active system so as to determine a packet having a sequence identifier greater than the value (CF) of the sequence identifier of the already transferred packet as a packet to be transferred next, and

when arrival of packets is interrupted for a predetermined time in the active system, another system is adopted as a new active system, and a packet received in the new active system is transferred downstream.

61. A packet transfer apparatus used in a packet transfer system including a plurality of packet transfer apparatuses provided in a packet sending side and a receiving side via equal to or more than two independent routes in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, the packet transfer apparatus comprising sending function means and receiving function means,

the sending function means comprising means for distinguishing a high reliability packet from non-high reliability packets by referring to a part of a packet header of the packet, and copying the high reliability packet into packets to send them to all of the independent routes;

the receiving function means comprising means for determining whether an arriving packet from the independent routes is the high reliability packet by referring to a part of the packet header, and as to high reliability packets, determining sameness of packet data arriving from the plurality of routes, and, when the same packets arrives from equal to or more than two routes, transferring only one of the same packets downward and discarding other packets, and when the same packet arrives from only one route, transferring the packet downstream.

62. The packet transfer apparatus as claimed in claim 61, wherein, when a packet to be transferred is an Ethernet packet, the part of the

packet header is any one of a port number at which the packet arrives in a previous switch of the packet transfer apparatus, a Type value of layer 3 protocol in a frame header, a destination MAC address in a frame header, a source MAC address, a priority (CoS value) included in 802.1Q VLAN tag, VLAN-ID, a DiffServ code/point value (ToS value) included in an IP header, a destination port number, a source port number of UDP, a destination port number, and a source port number of TCP,

when the packet to be transferred is a packet for MPLS, the part of the packet header is any one of a destination MAC address, a source MAC address, and a CoS value (Exp value) of a shim header, and

when the packet to be transferred includes an IP packet, the part of the packet header is any one of a ToS value of the IP packet, a source IP address, and a destination IP address.

63. The packet transfer apparatus as claimed in claim 61, wherein the receiving function means determines the sameness of packets arriving from the plurality of routes based on a value obtained by applying a predetermined function to each packet arriving from the plurality of routes.

64. The packet transfer apparatus as claimed in claim 61, wherein the receiving function means determines the sameness of packets arriving from the plurality of routes by referring to a

sequence identifier or a timestamp inserted in the sending side.

65. The packet transfer apparatus as claimed in claim 64, wherein, when one or more VLAN tags or shim headers are provided to the packet, the sending function means inserts the sequence identifier or the timestamp in the inside of an innermost VLAN tag or header in the VLAN tags or shim headers, and the receiving function means determines a position for reading out the sequence identifier or the timestamp inserted in the packet according to the inserted position.

66. The packet transfer apparatus as claimed in claim 64, wherein, a format of the sequence identifier or the timestamp inserted into the packet by the sending function means is the same as a format of a VLAN tag conforming to 802.1Q standard, and the sending function means writes sequence information or time information into a VLAN-ID field of the VLAN tag.

67. The packet transfer apparatus as claimed in claim 64, wherein the field in which the sequence information or the time information is written as the sequence identifier or the timestamp inserted into the packet by the sending function

means has an arbitrary length.

68. The packet transfer apparatus as claimed in claim 61, wherein the sending function means provides one or more route identifiers to a send packet, and reflects, to at least one route identifier among the route identifiers, priority that is provided to the packet in a user network.

69. The packet transfer apparatus as claimed in claim 68, wherein the sending function means provides the route identifier using a VLAN tag or a shim header to the packet, and determines priority by referring to a part of the packet header so as to reflect the priority to the route identifier,

wherein, when a packet to be transferred is an Ethernet packet, the part of the packet header is any one of a port number at which the packet arrives in a previous switch of the packet transfer apparatus, a Type value of layer 3 protocol in a frame header, a destination MAC address in a frame header, a source MAC address, a priority (CoS value) included in 802.1Q VLAN tag, VLAN-ID, a DiffServ code/point value (ToS value) included in an IP header, a destination port number, a source port number of UDP, a destination port number, and a source port number of TCP,

when the packet to be transferred is a packet for MPLS, the part of the packet header is any one of a destination MAC address, a source MAC

address, and a CoS value (Exp value) of a shim header, and

when the packet to be transferred includes an IP packet, the part of the packet header is any one of a ToS value of the IP packet, a source IP address, and a destination IP address.

70. A packet transfer apparatus used in a packet transfer system including a plurality of packet transfer apparatuses provided in a packet sending side and a receiving side via equal to or more than two independent routes in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, the packet transfer apparatus comprising sending function means and receiving function means,

the sending function means includes means for copying the packet so as to send copied packets to all of the independent routes;

the receiving function means comprising:

means for receiving packets from each of the independent routes;

means for referring to sameness identifying information of each packet so as to identify packets having the same information,

means for storing the sameness identifying information of packets already sent downstream for m (m is an integer equal to or greater than one) preceding packets from the newest packet, and comparing the stored sameness identifying information with sameness identifying information of a next arriving packet so as to determine whether the arriving packet is one already sent or not; and

means for sending downstream a packet, among the packets having the same information, that has not yet be transferred.

71. The packet transfer apparatus as claimed in claim 70, wherein the sameness identifying information is a sequence identifier or a timestamp inserted into the packet, or a value obtained by applying a predetermined function to the packet.

72. The packet transfer apparatus as claimed in claim 70, wherein the receiving function means includes a CAM (Content Addressable Memory) as a memory for storing the sameness identifying information.

73. A packet transfer apparatus used in a packet transfer system including a plurality of packet transfer apparatuses provided in a packet sending side and a receiving side via equal to or more than two independent routes in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, the packet transfer apparatus comprising sending function means and receiving function means,

the sending function means includes means

for inserting a sequence identifier for identifying sequence of packets into a send packet and copies the packet so as to send copied packets to all of the independent routes;

the receiving function means includes means for comparing values of sequence identifiers of plural packets received form the independent routes with a value (CF) of a sequence identifier of an already sent packet so as to send a packet downstream in at least one packet having a value as the sequence identifier that is greater than the value (CF) of the sequence identifier of the already transferred packet and that is the least value among the values of the sequence identifiers of the plural packets received from the independent routes.

74. A packet transfer apparatus used in a packet transfer system including a plurality of packet transfer apparatuses provided in a packet sending side and a receiving side via equal to or more than two independent routes in a communication network for transferring a packet by determining a transfer destination by referring to destination information of the packet, the packet transfer apparatus comprising sending function means and receiving function means,

the sending function means including means for inserting a sequence identifier for identifying a sequence of packets to a send packet and copying the packet so as to send copied packets to the independent routes;

the receiving function means including means for receiving packets from each of the independent routes and referring to the sequence

identifier of each packet so as to identify packets having the same information and the sequence, and to send downstream a packet among the packets having the same information in the order of the sequence of the packet,

wherein, in the receiving function means, a route from which a packet arrives first from the start of communication among the independent routes is regarded as an active system, the receiving function means compares a value (CF) of the sequence identifier of an already transferred packet with a value of the sequence identifier of a packet received in the active system so as to determine a packet having a sequence identifier greater than the value (CF) of the sequence identifier of the already transferred packet as a packet to be transferred next, and

when arrival of packets is interrupted for a predetermined time in the active system, another system is adopted as a new active system, and a packet received in the new active system is transferred downstream.